

## Organizations of knowledge

The “organization of knowledge” is a large and diffuse topic which can be studied at many different levels, ranging from the way an individual orders his or her understanding of the world privately or in publications, to the ways in which communities or institutions order knowledge, notably in pedagogical curricula and textbooks, professional structures, libraries and library catalogs, and other collective projects.<sup>1</sup> Although a few modern philosophers have addressed the problem of classifying knowledge, current practices of classification are mostly studied by anthropologists and sociologists.<sup>2</sup> Modern cultures and subcultures engage in both explicit and tacit classifications of knowledge, but today any particular organization of knowledge is generally acknowledged to involve a number of arbitrary choices and its success is often measured by pragmatic criteria of effectiveness, such as ease of use and economic efficiency. But this skeptical attitude toward the possibility of any organization matching the reality of knowledge or of the world is a fairly modern development, articulated for example in Jean Le Rond d’Alembert’s “preliminary discourse” to the *Encyclopédie* of 1751.<sup>3</sup>

In Renaissance Europe, on the contrary, many thinkers harbored the ambition of implementing the perfect organization of knowledge, though pragmatic, notably alphabetical, arrangements were also widespread in certain contexts. During the Renaissance the difficulty of ordering knowledge was greatly exacerbated in almost every field by the massive influx of material to be included, stemming from newly discovered worlds and newly recovered ancient texts as well as newly printed texts of all kinds, and by concurrent social and cultural changes associated with the development of printing, a rapid growth in higher education, and shifting patterns of patronage and social mobility. In this brief introduction to a complex topic I will focus on three areas in which Renaissance authors engaged in the organization of knowledge, proceeding from the least to the most pragmatic kinds of organization: explicit discussions of the classification of the disciplines; attempts at ordering historical and natural historical knowledge, especially

in large-scale compilations; and the organization of things of various kinds, especially books in libraries, sales catalogs, and bibliographies.

### Classification of the disciplines

Of the different forms of the organization of knowledge, the classification of the disciplines has received the most attention from intellectual historians and historians of philosophy, with a special focus on the numerous medieval treatises devoted to the question and various specific studies pertaining to Renaissance and later classifications.<sup>4</sup> In discussing in a few passages the parts of philosophy Aristotle canonized the topic of classification for philosophical discussion for centuries to come, although he did not devote as much attention to the question as later commentators made it seem. Aristotle became known for a bipartite division of philosophy into speculative and practical branches. In a number of passages Aristotle proposed a tripartite division with an additional third branch for “poetic” or productive knowledge, but commentators on Aristotle generally subsumed the productive under the practical disciplines. In the bipartite division ascribed to Aristotle the theoretical disciplines comprised metaphysics, physics, and mathematics, and the practical ones ethics, politics, and economics; logic and rhetoric were not properly part of philosophy, but preparatory to it.<sup>5</sup> But ancient philosophy also bequeathed to later commentators an alternative division of philosophy – a tripartite scheme in which philosophy was divided into logic/dialectic, ethics, and physics (including a relatively important status for mathematics). This tripartite classification of the sciences was traditionally associated with Plato in what is now recognized as a false attribution (made by Sextus Empiricus and Augustine among others) of a scheme devised by the Stoics.<sup>6</sup>

While these classifications remained abstract, Roman educational practice established a long-lived division of the disciplines into the seven liberal arts considered preparatory to philosophy: grammar, rhetoric and dialectic on the one hand, later known as the “trivium,” and arithmetic, geometry, music and astronomy on the other, forming the “quadrivium.” Varro is credited with the first enumeration of the seven liberal arts, to which he added medicine and architecture, in his lost work, *Disciplinarum libri IX* (c. 116–27 BCE). Clement of Alexandria and Augustine among other Church Fathers hailed the seven liberal arts as preparation for Christian doctrine, thus authorizing their central place in the medieval curriculum.<sup>7</sup> But Greek philosophy became increasingly inaccessible to the Latin West except through the Latin summaries and commentaries of Boethius and Augustine among others. Boethius (480–524 CE) offered a classification of philosophy which synthesized the “Platonic”/Stoic within the bipartite Aristotelian scheme, including the

quadrivium under theoretical philosophy. Boethius' classification proved particularly influential since it was adopted by Cassiodorus and mentioned by Isidore of Seville (alongside an alternative tripartite scheme) in their widely used manuals for the instruction of monks and priests respectively. Throughout the early Middle Ages educators and encyclopedists proposed a number of different classifications of the disciplines, featuring especially tripartite and bipartite divisions and the seven liberal arts.<sup>8</sup> The *Didascalicon* of Hugh of St. Victor (1096–1141) marks the height of complexity of medieval classification prior to the recovery of Aristotelian philosophy. His division was quadripartite (theoretical, practical, mechanical, and logical) and featured seven mechanical arts to match the seven liberal ones.<sup>9</sup>

The translation into Latin for the first time of many texts of Aristotelian philosophy, from Arabic and directly from Greek in some cases, triggered the expansion of teaching beyond the seven liberal arts. Since logic had already been included in liberal arts teaching (as a branch of the trivium), the new disciplines which were added to the curriculum at the newly founded universities were the three philosophies (physics, metaphysics, and ethics), themselves considered propaedeutic to study in the higher faculties of medicine, law, and theology. The recovery of Greek philosophy, accompanied by Arabic commentaries on it, coincided with the heyday of Latin treatises on the nature and division of the sciences, 1170–1270.<sup>10</sup> This classificatory activity can be understood as a response to the new texts, disciplines, methods, and institutions introduced in the teaching of philosophy in this period. The new texts translated into Latin also included an Arabic classification of the sciences by al-Farabi which inspired two Latin translations and a number of commentaries.<sup>11</sup> By 1255 Vincent of Beauvais could thus enumerate without deciding among them eight different positions on the classification of the sciences in his *Speculum doctrinale*.<sup>12</sup>

The more substantial treatments of Aristotelian philosophy which were now possible fostered new debates about classification, notably debates about the proper position of mathematics and the *scientiae mediae* which would recur in the Renaissance. Following Aristotle, most medieval classifications ranked the parts of philosophy according to their level of abstraction. Physics abstracted from individual material entities to discuss the forms and substances of material objects in general and thus promised *scientia* or certain knowledge; metaphysics concerned objects which were not dependent on matter at all and was thus clearly superior. Despite the abstract nature of its focus on the numerical relations between things, mathematics was considered inferior to physics because it did not adequately account for the complexity of physical reality. While many scholastics shared this assessment, a small set of disciplines which Aristotle had called “subordinate”

blossomed into a new category of “*scientiae mediae*” – intermediate between physics and mathematics because partaking of both – which increasingly challenged the sharp division and hierarchy between the two parent fields.<sup>13</sup> Optics, the science of weights, the measurement of bodies (stereometry) and physical astronomy increasingly became objects of study at the medieval university (in part due to the translation of Arabic texts in these fields). A few scholastics, notably at Merton College in fourteenth-century Oxford, argued especially for their importance.<sup>14</sup>

The explicit discussion of the classification of the disciplines in the Middle Ages remained a part of theoretical philosophy, generating a few full-blown treatises and more commonly (especially after the thirteenth century) remarks in introductory sections to philosophical treatises. These discussions generally had little impact on what was taught or studied, but served as an opportunity for authors to position themselves and to innovate within the spectrum of options that developed from the engagement of successive generations with ancient classification schemes. Renaissance treatments of classification drew heavily on models and methods inherited from the Middle Ages, although this debt was often not acknowledged. On problems of classification the recovery of lost ancient texts played a comparatively minor role in the development of Renaissance thought.<sup>15</sup> Most Renaissance classifications of the disciplines attempted an eclectic integration of new or newly invigorated disciplines with the Aristotelian schemes inherited from the Middle Ages; even traditionalist Aristotelian classifications and curricula shifted the balance of the disciplines. Only a few authors proposed bold departures from the Aristotelian legacy.

Humanists often used their classifications to support new claims for the centrality of the disciplines they favored, whether grammar, dialectic, history, or mathematics. A fine example of this strategy, widely circulated in its time and well studied today, is the *Panepistemon* of Angelo Poliziano, which began as an inaugural lecture in a course at the University of Florence, and was printed in numerous editions in Italy and in France, where it was also tacitly reused by at least two other authors. The vast array of sources Poliziano brought together in this eclectic synthesis of previous classifications is exemplary of the new range of humanist scholarship; his overarching argument was also typical of humanist disciplinary priorities, in that he hailed the *grammaticus*, rather than the philosopher, as the omniscient scholar capable of studying all texts.<sup>16</sup>

The mechanical arts generally experienced a rise in status in Renaissance classifications – they were more consistently included, whereas previously they had often been left out altogether.<sup>17</sup> Although the modern notion of “fine arts” only appeared in the eighteenth century, painting and sculpture

rose in status from their medieval standing as artisanal crafts; humanists debated not whether to include them among the arts and sciences, but whether to position them among the sciences or within eloquence as an art of expression.<sup>18</sup> Many disciplines once considered lowly and mechanical were given a lift in status by their association with mathematics – among them, for example, navigation, ballistics, and painting (e.g. through the use of perspective). In the sixteenth century mathematicians successfully touted the ancient pedigree of their discipline, which gained further prestige from the humanist recovery of texts of Greek mathematics and from the patronage of princes eager for both the prestige and the material benefits which mathematics promised.<sup>19</sup> Commentaries on Euclid offered the occasion for boasting of the areas which mathematics could encompass. In his commentary on Euclid Proclus had noted six kinds of mixed mathematics (already up from Aristotle's three); in his preface to the first English translation of Euclid in 1570, John Dee's list of mathematical disciplines named thirty fields of study, many of them terms which Dee coined for the first time in a bold forecast of mathematical achievements to come.<sup>20</sup>

Even among self-avowed Aristotelian traditionalists, the hierarchy of the disciplines in the sixteenth century was subject to new emphases as influential figures promoted their own disciplines and interests. Across Europe philosophy was taught to younger students in this period than in the Middle Ages.<sup>21</sup> In the training of Jesuits at the Collegio Romano Christopher Clavius (1538–1612) successfully argued for a greater place for mathematics and the mixed sciences. This change helped to foster a new mathematical approach to physics, along the lines of the interests of the Merton school of the fourteenth century, though Clavius did not refer to them or to earlier medieval debates about the status of the “*scientiae mediae*.”<sup>22</sup> Jacopo Zabarella at Padua argued in his treatise on the hierarchy of the disciplines for a greater autonomy for physics,<sup>23</sup> while the great Spanish scholastic Francisco Suárez (1548–1617) valued metaphysics above all as the discipline from which to prove God through reason.<sup>24</sup> Protestant scholastics also offered multiple variations on the traditional elements of classifications.<sup>25</sup>

Only a few late Renaissance figures openly rejected received classificatory schemes and the curricula to which they were related. In Paris in the 1550s and 1560s Petrus Ramus called for a complete overhaul of the university curriculum based on Aristotle. He proposed to replace it with a single dialectical method applicable to all fields which promised easy mastery of a subject through the systematic use of definition and division. Ramus attributed his reliance on these principles, as well as his special praise of mathematics, to the inspiration of Plato.<sup>26</sup> Ramus had no lasting impact on the French curriculum, but developed a considerable following, especially after

his death in the St. Bartholomew's Day killings, among German and English Calvinists.<sup>27</sup> The notion of unifying the disciplines through a single method was a shocking reduction of the Aristotelian conception of method, according to which every discipline had its own method appropriate to its subject matter and level of abstraction.<sup>28</sup> Ramism is best known for the dichotomous diagrams used to lay out the divisions of each subject, but diagramming predated Ramus who was indebted to the visual presentations devised by an earlier generation of pedagogues, including Rudolph Agricola and Jacques Lefèvre d'Étaples.<sup>29</sup> Diagramming also proved more versatile than Ramus' particular method and was used not only by full-fledged Ramists but also to present more traditional schemes of the disciplines, as in the ornate tables of philosophy published by Christofle de Savigny (1587).<sup>30</sup>

Francis Bacon was another bold opponent of received classifications and sorted the disciplines not according to the usual criteria of degree of abstraction or type of subject matter, but rather according to the three faculties of the mind – reason, memory, and imagination. Bacon was likely inspired by a late antique interpretation of Galen's partition of the soul which circulated from the Middle Ages down to Bacon's day.<sup>31</sup> In his *Advancement of Learning* (1605) and his own revised Latin translation of it in 1623 (as *De augmentis scientiarum*), Bacon emphasized the unity of the sciences and the role of practical as well as theoretical disciplines in furthering the governance of civil society.<sup>32</sup> His classification came to stand for the superiority of reason when d'Alembert selected it as the basis for his "tree of the sciences" in the *Encyclopédie*. But Bacon himself took no such position; he expected great things from history (a discipline of memory) and kept a place in his own work for the imagination (e.g. in the allegorical interpretation of ancient wisdom).

Changes in the classification of the disciplines during the Renaissance can be exemplified by the contrast between two encyclopedias organized around the disciplines – Gregor Reisch's *Margarita philosophica* (1503) and Johann Heinrich Alsted's *Encyclopedica* (1630). Reisch's 500-page quarto volume covered the seven liberal arts and the three philosophies. Alsted's four-volume work, totaling 2,400 folio pages, encompassed much more material and all kinds of new disciplines, for many of which Alsted coined his own terms. Alsted's propaedeutic *praecognita* were not the liberal arts, but rather, under the impact of Ramist thinking, focused on the methods of studying and the principles of the disciplines. Philologia was also preparatory to philosophy which was divided into theoretical and practical, followed by the three higher faculties. Alsted then described twenty-one mechanical arts (from brewing to playing musical instruments) and ended with a "farrago of disciplines" comprising forty-one fields of study from Cabala and the physics of Moses to the study of tobacco ("tobacologia"). In his attempt to harmonize

all knowledge Alsted introduced in the farrago some fields that were incompatible with approaches described in the earlier sections of his work.<sup>33</sup> The fact that the content of Alsted's *Encyclopedia* was bursting out of even its eclectic system of classification is perhaps one of the reasons why the next generation of disciplinary encyclopedias was arranged alphabetically rather than systematically.<sup>34</sup>

### The organization of facts in history and natural history

History was generally left out of Renaissance educational curricula because it was considered not complex enough to require instruction and too bulky to include.<sup>35</sup> But history, human and natural, offers a rich field in which to study how Renaissance scholars organized increasing quantities of material, in collections of specimens and manuscript notes and above all voluminous printed books. Human history was one of the disciplines favored by the humanists who viewed it as a source of examples of past errors and successes which could usefully inform the political and ethical decisions of their day.<sup>36</sup> Humanism fueled a special interest in ancient history, but medieval and contemporary histories were also printed in great numbers. Interest in history spawned a new genre offering advice about how to read and to write books of history known as the *ars historica*. In his *Method for the Easy Comprehension of History* (1566), for example, Jean Bodin recommended flagging in the margins of history books actions which proved useful or not and honorable or not so that one could easily find cases to guide one's own behavior. Passages annotated in the way Bodin recommended could also be copied out into a notebook under the appropriate heading (e.g. "useful and dishonorable actions," "useless and dishonorable" ones, or other topical headings) under which they could be retrieved again. This practice of note-taking fueled the publication of compilations of historical exempla which promised to offer all the rewards of history reading – memorable passages distilled from hundreds of histories – without the effort of reading the sources directly. The largest of these compilations reached thousands of folio pages filled with historical anecdotes selected as exemplary in some way; most collections of exempla and apophthegms were shorter, but faced on a lesser scale the same problems of selection, heading assignment, and arrangement.

Natural history also experienced unusually rapid growth during the Renaissance, stimulated at first by humanist attempts to identify the plants and animals named in the recently recovered treatises of natural history by classical authors, and further expanded by the many new species reported by travelers to the New World as well as by closer attention to the Old World. The number of known plants exploded from the 500 listed in the natural history

of Dioscorides, who ranked as the greatest botanical authority in 1550, to some 6,000 plants cataloged by Caspar Bauhin in 1623.<sup>37</sup>

Renaissance scholars faced an unprecedented growth of content in these fields, largely through the accumulation of discrete chunks of information (similar in many ways to what we call “facts”), but the methods they deployed to organize all that material were medieval in origin.<sup>38</sup> Selecting or summarizing from textual sources and sorting and storing these passages under topical headings constituted the basic operations underlying medieval florilegia and the compendia conventionally called “medieval encyclopedias.” The size and sophistication of these collections increased in the thirteenth century, during an earlier period of knowledge explosion, thanks to new practices of alphabetization (starting with the biblical concordances of the thirteenth century, then spreading to alphabetical indexes for many kinds of texts) and textual layout which facilitated reading by consultation rather than straight through. The use of different sizes of script, of running heads, rubrication and numbered sections and subdivisions was typical of scholastic as opposed to monastic manuscripts.<sup>39</sup> Collections of historical material in print experimented with new techniques (e.g. dingbats, different fonts and formats, greater use of centering and blank space) to increase the consultability of volumes which became steadily larger in size without, thanks to printing, becoming prohibitive in price.<sup>40</sup>

The assignment of a passage to a topical heading under which it could later be retrieved remained unchanged as the primary strategy for information management in the Renaissance, both in the commonplace notes that pupils in humanist schools were trained to take on their reading, and in the printed compendia which offered ready-made the kinds of notes Renaissance users would have wanted to have taken themselves.<sup>41</sup> The personal judgment of the note-taker or compiler governed the selection of the authors and texts to excerpt and of the particular passages copied out (and sometimes tacitly rephrased in the process), then of the heading under which to file each passage. The arrangement of the headings in the collection (and to a much lesser extent of the passages within a heading) was also decided by the compiler. In manuscript collections headings were generally formed in the order in which they occurred to the note-taker in the course of reading, whatever the sequence of texts; manuscript notes almost never discussed the arrangement of headings. In print Renaissance compilers often did justify their choice of organizational scheme from among the three principal options of miscellaneous, alphabetical, or systematic arrangements.

The self-consciously miscellaneous order found in a number of Renaissance compilations was without medieval antecedent; the authors of miscellanies invoked the model of the Roman author Aulus Gellius who claimed to have



composed his *Attic Nights* in the order in which he read texts and made observations on them. Miscellaneous order was probably rarely due to simple happenstance and often betrayed loose topical associations.<sup>42</sup> Nonetheless various miscellanies proclaimed that a fortuitous arrangement added variety to the pleasure of reading. Typically one or more alphabetical indexes appended to the miscellaneous text made the material accessible to the user in search of a specific topic.<sup>43</sup> An alphabetical order of headings was common in medieval florilegia and perpetuated in many Renaissance collections of quotations and anecdotes; it offered the greatest ease of use, but was criticized for being dictated by the arbitrariness of “grammar.” A systematic order on the contrary promised conceptual beauty in matching the order of things.<sup>44</sup>

Renaissance encyclopedic works featured many different systematic schemes, from the chain of being to the decalog.<sup>45</sup> Some purported to facilitate memorization; others strove for pansophy, or the wisdom that comes from knowing all things and their interconnections.<sup>46</sup> Large-sized printed compilations typically featured one or more alphabetical indexes which allowed for an alternative mode of access.<sup>47</sup> This was the case for one of the most elaborately classified compilations, the *Theatrum humanae vitae* (1565) in which Theodor Zwinger gathered historical exempla on a grand scale under topical headings with multiple layers of sections and subsections carefully arranged (and rearranged in two subsequent editions published in his lifetime) according to elaborate Ramist diagrams.<sup>48</sup> Zwinger prided himself on devising an order which was not chronological, but “rhapsodic,” as he called it, designed to highlight the ethical value of his material, which he sorted broadly by vices and virtues. That Zwinger’s systematic order proved effective for users is doubtful; one contemporary commented that it was difficult to find anything in Zwinger’s *Theatrum* except through the index.<sup>49</sup> The work was indeed published with an increasing number of alphabetical indexes, by topical heading first, then by proper names and “memorable words and things” (cf. our notion of “keyword”). In enlarging on Zwinger’s *Theatrum* in his *Magnum theatrum* of 1631 Beyerlinck resorted to alphabetizing the major headings, noting that “many approved little of the systematic order for history.”<sup>50</sup>

Natural historians grappled with similar tensions between the ideal of a system that would represent faithfully the complexity and hierarchy of nature and the practicalities of retrieving information in large-scale compilations. Renaissance natural history is well known for its lack of a “scientific classification” – modern classifications were introduced in the eighteenth century for both plants and animals (e.g. by Linnaeus and Cuvier among others). Renaissance classifications of plants and animals used categories formed in antiquity (by Aristotle, Theophrastus, and Dioscorides especially),

based on common experience: tree, shrub, undershrub and herb; quadrupeds, reptiles, fish, and birds. Subdivisions within these broad categories varied with different authors. Ulisse Aldrovandi, who studiously avoided any use of alphabetical order as merely grammatical and arbitrary, sorted birds in his three-volume *Ornithologiae* according to their habits and habitats (in three main categories: birds of prey, birds that roll in the dust, birds that live on or near water), then according to specific physical features (similarities in beaks, feathers, etc).<sup>51</sup> Similarly, in botany, “small-scale” groupings of similar plant types were juxtaposed with one another rather arbitrarily.<sup>52</sup>

Alphabetical order had already been used for listing plants and animals in compendia starting in the thirteenth century.<sup>53</sup> In the sixteenth century natural historians who opted for alphabetization acknowledged the arbitrariness of “grammatical order,” but explained its virtues, as Conrad Gesner did in the preface to his four-folio volume *Historiae animalium*: “the utility of lexica [like his] comes ... not from reading them from beginning to end, which would be more tedious than useful, but from consulting it from time to time.”<sup>54</sup> By referring to his natural histories as lexica, Gesner highlighted their similarity to the genres focused on organizing words and books for which alphabetical order was common (though not universal). Although Gesner’s natural histories were widely respected and his choice of alphabetical order was imitated by some, many continued to search for the perfect systematic order. During the 1620s Federico Cesi developed detailed plans for a “theater of nature” which would represent the reality of nature in all its complex relationships, but the plans were never implemented beyond printing a few diagrams and constituting a large collection of exquisite drawings from nature.<sup>55</sup> Caspar Bauhin took a more pragmatic approach in listing thousands of kinds of plants, with references to the authors who described them; Bauhin offered no charts nor even a table of contents outlining the order he followed – the work is accessible primarily through the alphabetical index.<sup>56</sup>

### The organization of objects

After considering theoretical classifications of the disciplines and the arrangements of textual excerpts in historical compilations, I will turn briefly to the organization in Renaissance collections of physical objects of different kinds, from natural specimens to books. However, these collections (even in libraries) have not been preserved with their Renaissance ordering undisturbed, so that our evidence for them is indirect, from representations of the collections in images or through written inventories and catalogs.

Cabinets of curiosities brought together the widest array of objects, from unicorn horns (narwhal tusks) to American bows and exquisitely crafted gemstones. Judging from the images we have of these collections, the physical constraints of the objects and the display space (usually a single room) often dictated a rather haphazard physical arrangement.<sup>57</sup> Given the expenses and difficulties of amassing such collections, most were not very large and did not require extensive organization for pragmatic reasons. But in manuscript and printed inventories owners generally grouped their objects according to basic categories, notably in sections for *naturalia* and *artificialia*, each with further subdivisions, e.g. for minerals, plants, shells, medals, and paintings. Within each section the items were not clearly ordered, though the most significant and costly items in a section would typically be listed first.<sup>58</sup> The most sophisticated inventories, notably of the lavish Kunstkammern at Ambras and Prague in the Holy Roman Empire, added a category of *scientifica* for instruments of scientific observation and emphasized a hierarchy of materials, from specimens in their unadorned natural state to those which blended nature and art, culminating in those which displayed the greatest level of human artistry.<sup>59</sup> Distinct from cabinets of curiosities, with their encyclopedic scope and often symbolic significance, were the collections of natural specimens gathered and organized for practical or pedagogical purposes in markets, homes, gardens, laboratories, and anatomy theaters – all of which sites of knowledge have recently started to garner scholarly attention.<sup>60</sup>

Collections of coins and epigraphs stimulated by humanist interest in antiquity also required organization, especially since they reached much larger proportions than most cabinets of curiosities – coins were small and not yet very expensive and epigraphs were recorded by copying out (though some collected the stone inscriptions when they could). Coins could be sorted (at least in the books describing them – the actual order of the collection is generally not known) by emperor, time and place, by size, by metal, by tails or heads.<sup>61</sup> A massive collection of epigraphs by Jan Gruter was organized in twenty classes by author of inscription and published with twenty-four alphabetical indexes produced by Joseph Scaliger according to a variety of criteria (interesting words used, temples at which they were found, professions or family members mentioned, among others).<sup>62</sup>

The most widely used and collected objects were books. Personal libraries increased over tenfold in size from 1450 to 1650 as a result of the lower cost, greater availability, and increasing accumulation of printed books.<sup>63</sup> Most personal collections were not cataloged – we know of them through inventories after death which were often arranged in order of decreasing commercial value. Institutional libraries typically maintained more or less sophisticated inventories for internal use (to record the movement of books acquired, lost, traded,

or lent out), so that a formal catalog was not always produced. Examples of library catalogs arranged by author and/or subject (and even one union catalog covering the holdings of multiple monasteries) existed in the Middle Ages.<sup>64</sup> But the genre developed much more in the Renaissance: libraries were increasingly open to users beyond in-house residents of a college or monastery; printed catalogs were useful to attract patronage or boost reputation. The first printed catalog was that of the Bodleian (1605); interleaved and annotated copies of this printed catalog were also used as catalogs by other libraries.

Sales catalogs appeared soon after printing to aid in attracting buyers for new imprints. Used books were also traded, though we have little information about this trade, except through the practice of auctioning larger book collections which began in the Low Countries in the late sixteenth century. Catalogs of books for sale (auction and booksellers' catalogs) generally observed practical considerations of use and storage in addition to basic disciplinary divisions: books were sorted into size (folio, quarto, octavo) and languages (Latin and the separate vernaculars). These catalogs typically started with the largest (and most expensive) items and moved from the most prestigious disciplines to the newer, smaller fields – from theology, law, and medicine to mathematics and poetry. Within each section (broken down by discipline, size, and language) there were not too many books to list them in random order.<sup>65</sup>

Library catalogs on the other hand were generally produced only for the largest libraries and were therefore considerably longer and made greater use of alphabetical lists by author – either in a single alphabetical list, or, as in the case of the Bodleian catalog of 1605, within sections for each of the disciplines. Subject indexes to the lists of authors were rare and dependent on the diligence of the librarian who was often also charged with many other tasks.<sup>66</sup> Whether printed or manuscript, Renaissance library catalogs were drawn up with few provisions for new additions – catalogs did not take the form of moveable slips before at least the eighteenth century, although slips were sometimes used in the process of alphabetizing and could even be glued onto sheets to form the catalog itself.<sup>67</sup> Typically catalogs grew by annotation for a time; then a new catalog was made to supersede the old.

The bibliography was another essential tool for managing the knowledge of books in the Renaissance since it listed books beyond any single collection and could include even authors by whom little or nothing was actually extant. Conrad Gesner's attempt at an exhaustive listing of all authors and works in Greek, Latin and Hebrew in his *Bibliotheca universalis* (1545) far surpassed in scope and ambition the few medieval contributions to the genre.<sup>68</sup> Gesner arranged the material in a single alphabetized list of authors but planned to add a topical index to all their works; though this plan was not fully carried out, Gesner did publish an associated volume (the *Pandectae*, 1548) which

listed the relevant books and sections of books by discipline and topical subheadings.<sup>69</sup> Gesner favored alphabetical order as facilitating consultation, but the first bibliographer of French vernacular books articulated a further virtue of alphabetical order when dealing with living authors. La Croix du Maine explained that he would order his collection of treatises on the noble houses of France by “the order of a, b, c, . . . so as to anger no one,” as he would if he attempted a hierarchical order.<sup>70</sup> The use of alphabetical order in the Renaissance should not be interpreted as a rejection of social or intellectual hierarchies, but it presented pragmatic advantages for the reader as well as the author, in sparing them the difficulties of ordering information according to an increasingly complex understanding of reality.

### In summary

During the Renaissance institutions often did not seem to change much. Old universities were governed by medieval statutes and served as the models for the many new foundations; only a few schools were designed to institutionalize the humanist disciplines, such as the trilingual colleges in Louvain (1517) and Paris (1530). Academies were only just beginning to offer durable alternative sites for intellectual work (e.g. Accademia del Disegno, 1561; Accademia dei Lincei, 1603; Académie française, 1630). Though it was an increasingly eclectic Aristotelianism, Aristotelianism continued to dominate university teaching (until the 1690s in Paris, for example).<sup>71</sup> At the same time the Renaissance was a period of great intellectual and cultural ferment: printing, humanism, and new discoveries stimulated new areas of study and the accumulation of much new material. History and natural history grew especially fast, despite minimal institutional support, by appealing to the interests of a broadening educated elite: examples from human history would improve current political and ethical decisions and the collection of natural historical specimens and descriptions would promote a greater appreciation of God’s creation and the potential for better mastery of it (notably in medicine and pharmacy). Activities once considered artisanal and mechanical acquired new status from court patronage and from the introduction of mathematical techniques (whether successful or only prospective). The proliferation of books fueled the growth of compilations which offered the best selections from all those books one didn’t have money to buy or time to read oneself, as well as increasingly sophisticated library and sales catalogs.

Many of the structures used for organizing knowledge in the Renaissance – the hierarchical classification of the disciplines, the use of headings to sort and store material, and the use of alphabetical order in texts, indexes and

catalogs – were inherited from the Middle Ages. But these structures were expanded and transformed during the Renaissance as they accommodated new fields of study and massive quantities of new material. Renaissance authors experimented with different classifications of the disciplines and many kinds of order, from the miscellaneous to the systematic. Alphabetical order, already prevalent in dictionaries, bibliographies, and many florilegia in the Middle Ages, appeared increasingly in other genres too during the Renaissance: in library catalogs, in some natural histories, and as an index to improve the useability of miscellaneous or systematically arranged compilations. But the dominance of alphabetical order which persisted until recently (until the rise of electronic media) began only in the late seventeenth century. The organization of knowledge in the Renaissance took many forms, often complex and original, which invite further study at the intersections of the cultural history and the history of the book with intellectual history and the history of philosophy.

## NOTES

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1. For some discussion of the meanings of the “organization of knowledge,” see Bliss 1929, ch. 4. For the best entries into the topic, see Burke 2000, esp. ch. 5 and Kelley and Popkin 1991; for a somewhat later period, see Daston 1992, 207–20.
2. For a philosophical approach see Piaget 1967. Lévi-Strauss interpreted classification as an attempt to control the world in Lévi-Strauss 1962. For a sophisticated interdisciplinary approach see Bowker and Star 1999.
3. On this point and eighteenth-century classifications more generally, see Yeo 2003, 248; Tonelli 1975, 265.
4. Still useful is the general historical overview by Flint 1904; see Frängsmyr 2001.
5. For the tripartition see *Topics* VI, 6, 145a15; for allusions to bipartition see *Topics* VII, 1 and *Metaphysics* I, 1 and VI, 1. For further references to Aristotle and discussion see Mariétan 1901, ch. 1. For a discussion of how Aristotle’s tripartite division of speculative philosophy was indebted to Plato’s tripartition of being, see Merlan 1953, 59–87.
6. On the Stoic tripartite division of philosophy, see White 2003, 124. On the attribution of a tripartite classification of philosophy to Plato by Sextus Empiricus, see Flint 1904, 70 (citing *Adversus Mathematicos* VII, 16); on Augustine’s role in this attribution, see Paulmier-Foucart 2004, 229, citing *De civitate dei*, VIII, 4.
7. My discussion of medieval classifications is especially indebted to Weisheipl 1965 and 1977. Augustine was suspicious of astronomy (*De doctrina Christiana*, II, 29) but planned a *disciplinarum libri* on all seven liberal arts; see Weisheipl 1965, 57.
8. See Weisheipl 1965, 58–65 for diagrams and more detailed discussion of the primary sources: Boethius, *In Isagogen Porphyrii Commentarii*; Cassiodorus, *Institutiones*, II, 3, 4 and Isidore, *Etymologiae*, II, 24, 1.

9. Hugh of St. Victor, *Didascalicon*, 1, 4–11. See more generally Whitney 1990.
10. Weisheipl 1977, 475. See also Dahan 1990; studies of specific classifications include Steneck 1975 and Lutz 1956.
11. Weisheipl 1965, 475. On Arabic classifications including al-Farabi's fivefold division of the sciences (into sciences of language, logic, mathematics, physics, and politics), see Jolivet 1977.
12. Vincent offers excerpts on classification by Isidore of Seville, Hugh of St. Victor, Richard of St. Victor, Michael Scot, Aristotle, al-Farabi, Avicbron, and Augustine. Vincent of Beauvais, *Speculum doctrinale*, book 1, chs. 14–18, available in French translation in Paulmier-Foucart 2004, 231–7.
13. On Aristotle's ideas on this point, see Mariétan 1901, 30ff. On the emergence of the notion of “scientia media” in the Middle Ages (notably with Thomas Aquinas), see Gagné 1969.
14. These Platonizing scholastics included Robert Grosseteste, Roger Bacon, and Robert Kilwardby; see Lindberg 1977, 477–8.
15. Two examples are cited in the literature: Ficino translated work by the Greek Albinos, a Platonic-eclectic author of the mid-second century, who proposed a synthesis between the Aristotelian and the Platonic/Stoic classifications; see Tonelli Olivieri 1991, 80, n. 69. Geminus of Rhodes developed the category of “sensible mathematics” as a more inclusive category than Aristotle's “mixed” sciences; excerpts from Geminus were printed and translated in the Renaissance in the *Sphaera* of Proclus (pseudo) (c. 1522). On Geminus and his influence, see Mandosio 1994.
16. His classification is ultimately quite familiar: tripartite (theoretical, practical and logical), with careful attention to mathematics and to the seven mechanical arts (from Hugh of St. Victor). See Mandosio 2002 and 1997. On the *fortuna* of this text and its reuse by other authors in sixteenth-century France, see Mandosio 2000a. See also Maier 1960. For another humanist classification, see Mandosio 2000b.
17. On the rise of the mechanical arts, see Rossi 1970.
18. Kristeller 1951; for the Renaissance period see Farago 1991.
19. See Rose 1975; on the parallel role of occultists like Agrippa of Nettesheim in promoting mathematical sciences, see Grafton 2002.
20. See Dee's preface in Euclid 1570, p. 1–50. Also available in Dee 1975.
21. Tuck 1998, 17–19.
22. Ariew 1990.
23. Mikkeli 1997.
24. Lohr in Schmitt *et al.* 1988 and Lohr 1991. On Spanish classifications more generally see Jacobs 1996.
25. See Freedman 1994, esp. 51–6 for a number of diagrams of specific systems.
26. The best account of Ramus remains Ong 1958; see 43–4 on the role of Plato in Ramus' thought.
27. See Feingold, Freedman, and Rother 2001.
28. Gilbert 1960; see also Edwards 1976.
29. Ong 1958, 74–91. For antecedents to Ramus' use of dichotomous diagrams see also Murdoch 1984 and Höltingen 1965.
30. De Savigny 1587; on this point, see Burke 2000, 97–8.
31. Tonelli Olivieri 1991.
32. Kusakawa 1996.

33. On Alsted's strategies of harmonization, see Hotson 2000 and Blair 2000a.
34. Notably as "dictionaries of the arts and sciences"; see Yeo 2001.
35. Gilbert Jacchaues (1635) as quoted in Blair 1997, 35. In Renaissance classifications history was variously defined narrowly as human history or broadly as human and natural history; on these interactions see Mandosio 1995 and Pomata and Siraisi 2005.
36. On exemplar history see Nadel 1964.
37. See Ogilvie 1997.
38. For an entry into the recent historiography on the rise of the notion of "fact" in the early modern period, see Blair 2005, 283ff. and Daston 2001. On the problem of overload more generally, see Blair 2003.
39. For an introduction to their many studies on scholastic tools and *ordinatio* see M. and R. Rouse 1991, esp. chs. 4–7.
40. Medieval florilegia were often brief, whereas the most widely printed Renaissance florilegium, Domenico Nanni Mirabelli's *Polyanthea*, started at c. 500,000 words and grew in successive editions to about three million words by 1600. The all-time largest encyclopedia of the Middle Ages, Vincent of Beauvais' *Speculum maius* weighed in at about three million words, while its late Renaissance equivalent, Laurentius Beyerlinck's *Magnum theatrum* (1631), reached fifteen million words. Although these very large reference books were of course very expensive relative to smaller books, the cheapening of book production by printing made it feasible to produce and market such large works.
41. For an entry into the considerable literature on commonplacing see Moss 1996 and Blair 1992, and on note-taking more generally, Blair 2004. On marginal annotation, see Fera *et al.* 2002.
42. This point is made convincingly about Gellius' arrangement, for example, in Holford-Strevens 2003, 30–6.
43. On the virtues of miscellaneous order see Poliziano 1522, preface. On the genre of the miscellaneously arranged commentary see Blair 2006. On the relation of Renaissance commentary to ancient and medieval commentaries, see Pade 2005.
44. See the tag "nothing is more beautiful than order," as in Fatio 1971.
45. See, respectively, Girolamo Cardano, *De subtilitate* (1551), Andreas Hondorff, *Promptuarium exemplorum* (1572) as discussed, among over a dozen different kinds of systematic orders, in Michel 2002, at 46, 58.
46. Most famously Giulio Camillo Delminio designed a "theater of memory" as a physical space which one could enter to contemplate an ordered display of all knowledge; on his program and its context and impact see Bolzoni 2001. For a rich survey of pansophic writing, see Schmidt-Biggeman 1983.
47. On Renaissance indexing see Blair 2000b.
48. Zwinger 1565, with ever larger re-versions in 1571 and 1586 and a posthumous reprinting (with an additional index) in 1604.
49. Keckermann 1614, 224 (misprinted as 210).
50. Beyerlinck 1666. sig. [e3]v; this preface is not present in all copies of the edition of 1631, though the shift to alphabetical had been made. Nonetheless, the articles in Beyerlinck were often very long ("Bellum" runs to 106 pages) and maintained Zwinger's subdivisions within them.
51. For an excerpt in translation, see Aldrovandi 1963; see more generally Hall 1991. On Aldrovandi's organizational practices, which included drawing up



- hierarchical tables to accompany his collection of natural historical specimens, see Findlen 1994, 60–2.
52. Ogilvie calls these groupings “pre-theoretical”; Ogilvie 2006, 218–19.
53. Hünemörder 1983.
54. Gesner 1551, sig. β1v.
55. See Freedberg 2002. On the use of tables and grids in natural history, see Swan 2002. A grid-like layout of natural specimens in a box with 6 × 6 pigeonholes called a *pantotheca* is described in the opening pages of the “Colloquium heptaplomeres” traditionally ascribed to Jean Bodin (c. 1590); see Bodin 1975.
56. Bauhin 1623.
57. For some examples see Findlen 1994, esp. ch. 3. Michele Mercati’s cabinets for arranging metals constitute a rare case in which the physical arrangement matched a conceptual one. The plates of Mercati’s *Metallotheca* were made in 1580 but printed only in 1717; see Cooper 1995.
58. For an example see Trichet c. 1635.
59. On this interpretation of the *Kunstkammer* as a celebration of Promethean ambitions (notably in automata), see Bredekamp 1995. In a work which became an important model for the Habsburg inventories, though it was an abstract classification associated with no real collection, Samuel Quiccheberg offered a fivefold division of a *Kunstkammer* into objects pertaining to the ruler and his realm, arts and crafts, natural specimens, *artificialia* and paintings; for a modern edition and German translation of this work of 1565 see Quiccheberg 2000.
60. See Findlen 2001; Park and Daston 2006, chs. 8–9, 12–13. On the symbolic role of cabinets of curiosities, see Pomian 1990.
61. On collections of medals, see Schnapper 1988, 133ff. I am also grateful to Brian Ogilvie for expert advice on this point.
62. Gruter 1603.
63. For example, French royal magistrates in the late fifteenth century typically owned around sixty books; see Geneviève Hasenohr in Vernet 1988, 239. In the sixteenth century French magistrates ordinarily owned 500–1,000 books and up to 3,000 books in exceptional cases. See Charon-Parent 1988.
64. Derolez 1979.
65. See Pollard and Ehrman 1965 and Charon and Parinet 2000. For an example see de Jonge 1977.
66. For an example of elaborate cataloging at the cathedral library of Zurich, see Germann 1994. On late sixteenth- and seventeenth-century librarians and a number of their classifications, see Caillet 1988.
67. See Jayne 1956. For examples of catalogs formed by annotating a printed catalog or from alphabetized manuscript slips glued onto sheets, see the late seventeenth-century catalogs of the Bibliothèque Mazarine, Paris, MS 4138 and 4134 respectively. Concerning the first library catalog on cards, see Krajewski 2002, 35ff. On the use of slips more generally see Blair (forthcoming).
68. Medieval bibliographies were few in number and generally focused on a geographical area or a religious order; see M. and R. Rouse 1986.
69. On Gesner see Zedelmaier 1992, and (among other articles) Mueller 1998.
70. La Croix du Maine 1584, sig. aiiijr.
71. See Schmitt 1983a and Brockliss 2002.